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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample is included. (AG)

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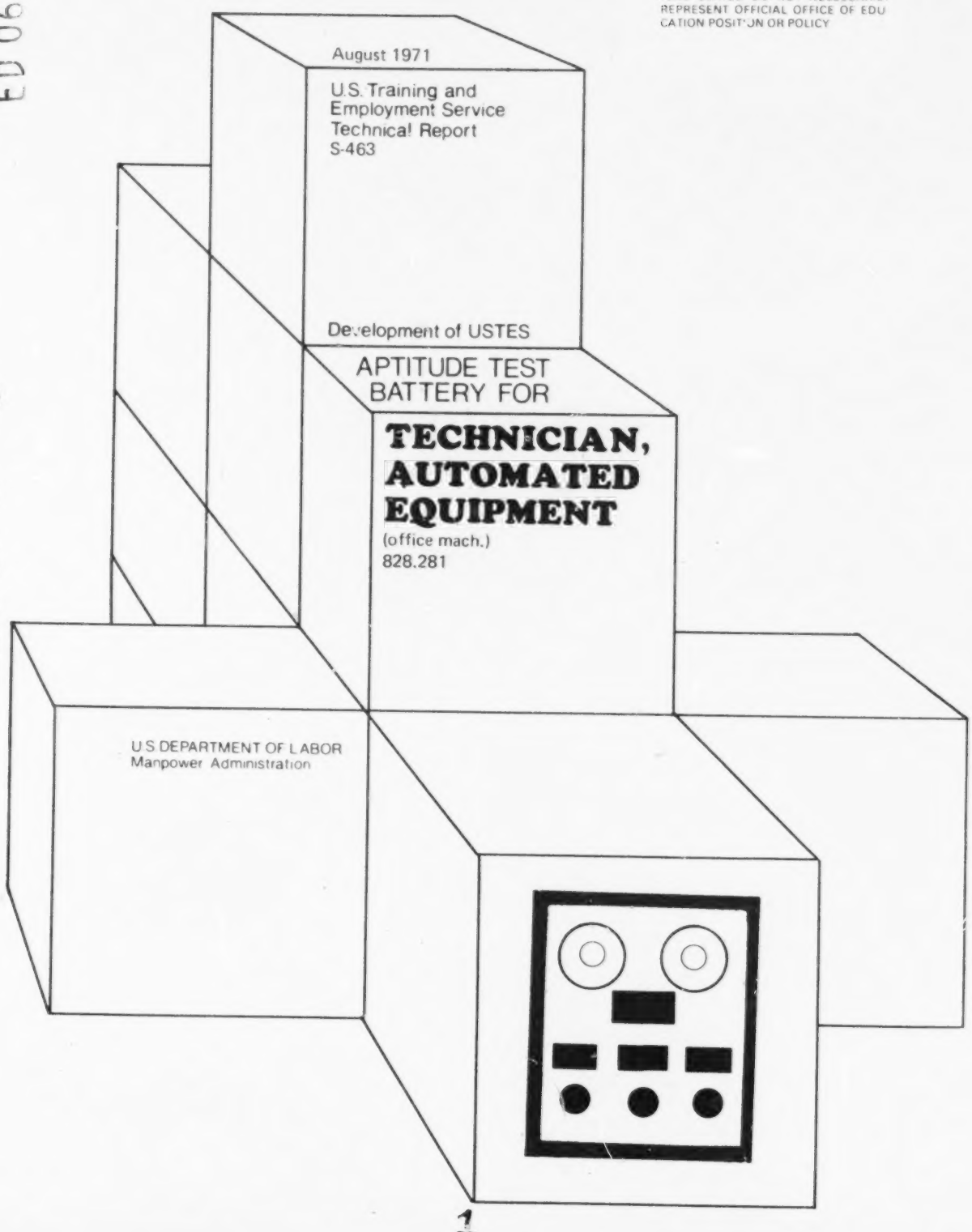
S-463



ED 069651

Technical Report on Development of USTES Aptitude Test Battery

For . . . . .

Technician, Automated Equipment (office mach.) 823.281

S-463

(Developed in Cooperation with the
New York State Employment Service)

U.S. DEPARTMENT OF LABOR
Manpower Administration

August 1971

2

FOREWORD

The United States Training and Employment Service General Aptitude Test Battery (GATB) was first published in 1947. Since that time the GATB has been included in a continuing program of research to validate the tests against success in many different occupations. Because of its extensive research base the GATB has come to be recognized as the best validated multiple aptitude test battery in existence for use in vocational guidance.

The GATB consists of 12 tests which measure 9 aptitudes: General Learning Ability, Verbal Aptitude, Numerical Aptitude, Spatial Aptitude, Form Perception, Motor Coordination, Finger Dexterity, and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, with a standard deviation of 20.

Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, in combination, predict job performance. For any given occupation, cutting scores are set only for those aptitudes which contribute to the prediction of performance of the job duties of the experimental sample. It is important to recognize that another job might have the same job title but the job content might not be similar. The GATB norms described in this report are appropriate for use only for jobs with content similar to that shown in the job description included in this report.

GATB Study #2831

DEVELOPMENT OF USTES APTITUDE TEST BATTERY

For

Technician, Automated Equipment (office mach.) 823.281-044

S-463

This report describes research undertaken for the purpose of developing General Aptitude Test Battery (GATB) norms for the occupation of Technician, Automated Equipment (office mach.) 823.281-044. The following norms were established:

GATB Aptitudes	Minimum Acceptable GATB Scores
N - Numerical Aptitude	95
S - Spatial Aptitude	100
F - Finger Dexterity	75
M - Manual Dexterity	100

RESEARCH SUMMARY

Sample:

50 male workers employed by Friden Cooperation in 31 cities in 19 States. All sample members were receiving training at the Eastern training facility in Rochester, N.Y. Minority group information was available for only 27 sample members. Two of these individuals were Negroes while the remaining 25 were nonminority group members.

Criterion:

Supervisory ratings

Design:

Concurrent (test and criterion data were collected at approximately the same time.)

Minimum aptitude requirements were determined on the basis of job analyses and statistical analysis of aptitude mean scores, standard deviations, aptitude-criterion correlations and selective efficiencies.

Concurrent Validity:

Phi Coefficient = .48 $P/2 < .0005$

Effectiveness of Norms:

Only 68% of the non-test-selected workers used for this study were good workers; if the workers had been test-selected with the above norms, 82% would have been good workers. 32% of the non-test-selected workers used for this study were poor workers; if the workers had been test-selected with the above norms, only 18% would have been poor workers. The effectiveness of the norms is shown in Table 1:

TABLE 1

Effectiveness of Norms

	Without Tests	With Tests
Good Workers	68%	82%
Poor Workers	32%	18%

SAMPLE DESCRIPTION

Size:

N = 50

Occupational Status:

Employed Workers

Work Setting:

Workers were employed at Friden installations in 31 cities in 19 States as follows:

California - Los Angeles 2
Connecticut - Bridgeport, Hartford
District of Columbia - Washington 2
Florida - Jacksonville - Tampa
Illinois - Chicago 4, Springfield
Indiana - Evansville
Kentucky - Lexington
Maine - Portland 2
Maryland - Hagerstown 2
Massachusetts - Boston 3
Michigan - Detroit
Missouri - St. Louis 4
New Jersey - Newark
New York - Rochester 2

North Carolina - Charlotte, Raleigh 2
Ohio - Cincinnati 2, Cleveland 2, Columbus, Dayton 3, Lima, Toledo
Pennsylvania - Pittsburgh
South Carolina - Charleston
Texas - Dallas
Virginia - Norfolk 2, Parkersburg, Richmond

Employer Selection Requirements:

Education: High school graduate or equivalent.
Experience: Minimum one year as Customer Service Trainee for which prerequisites were successful completion of centralized training courses in Rochester in an appropriate product group, plus an additional year of experience with successful further central training, or six months' on-the-job training.
Tests: With a beginning trainee, the Bennett Test of Mechanical Comprehension was used fairly often, not as a screen but "to confirm learning from experience." In the current sample, the Bennett percentile scores of 23 of the 50 were secured; a Pearson r of -.011 was found between these scores and the criterion.
Other: Personal interview and physical examination.

Principal Activities:

The job duties for each worker are comparable to those shown in the job description in the Fact Sheet.

Minimum Experience:

All workers had completed a year's traineeship, plus an additional year with further central training, or an additional six-months' on-the-job training.

TABLE 2

Means, Standard Deviations (SD), Ranges and Pearson Product-Moment Correlations with the Criterion (r), for Age, Education and Experience
N = 50

	Mean	SD	Range	r
Age (years)	27.9	5.7	20-44	.284
Education (years)	12.5	1.1	8-15	.025
Experience (months)*	13.4	18.1	0-83	.237

*Since criterion data collection from such widespread sources involved long delays, experience is as of the date of the criterion.

EXPERIMENTAL TEST BATTERY

All twelve tests of the GATB, B-1002B, were administered to the validation sample during June 1968 and March 1969.

CRITERION

The criterion data consisted of supervisory ratings of job proficiency.

Rating Scale:

A uniform company rating scale was used for this study. The scale consisted of seven factors, each with five alternatives of degree. Each item was given a unit weight, which was multiplied by 1 to 5 depending on its location on the scale.

The seven factors were used to rate the individual in isolation, and for the purpose were arranged in seven rows, with the five scale-positions for columns.

They were also used to rate the individual with his co-workers (most of whom had not been tested) and for this purpose the individuals' names were set in rows, and the seven factors made up seven columns, each divided into five subcolumns for scalar positions. In addition, each of the five subcolumns was given a limiting percentage to make up a forced distribution 10%, 20%, 40%, 20% and 10% respectively of the total number being rated.

The individual rating described above is called an IF rating, an individual rating in the field, and the ratings with the peers is called a GF, a group rating in the field. Whenever possible, the individual was given a second IF and GF rating several months later. The final criterion consisted of the first GF rating (GF-1) for 45 individuals. However, since these data were unavailable for five sample members, IF-1 ratings for these individuals were used as the final criterion.

Reliability:

Various combinations of the four ratings were used to compute reliability coefficients. These combinations are shown below:

Combination No.	GF-1	IF-1	GF-2	IF-2	n
1	14	14	14	14	14
2	15	15			15
3	3	3	3		3
4	2		2		2
5	3				3
6		4			4
8	8		8	8	8
10		1		1	1
Sums	45	37	27	23	N50

In general, since the paired GF's and IF's in each round were closest in time, it might be expected that halo contamination would be greatest between those measures. Thus, the 14 GF1's correlated .912 with the 14 GF2's in combination #1. However, the 14 GF2's in the same combination correlated only .760 with the related IF2's.

The 40 GF's in combinations 1,2,3 and 8 correlated .810 with their 40 corresponding IF's and the 54 GF's of the same 40 subjects correlated .842 with their 54 IF's.

Ideally, most respect is due the GF measure because of its nature; unfortunately this study permitted no freedom in collecting other data, and allows a partial estimate of GF1's vs GF2's by using these measures in combinations 1,3,4 and 8 and an N of 27. The correlation is .828 and together with the other data gives the impression that reliability is sufficiently high, in spite of the great number of ratees involved and the widespread field locations and relatively large number of raters.

Criterion Score Distribution:

Possible Range:	50-250
Actual Range:	70-230
Mean:	134.0
Standard Deviation :	39.0

Criterion Dichotomy:

The criterion distribution was dichotomized into low and high groups by placing 32% of the sample in the low group to correspond with the percentage of workers considered unsatisfactory or marginal. Workers in the high criterion group were designated as "good workers" and those in the low group as "poor workers". The criterion critical score is 110.

APTITUDES CONSIDERED FOR INCLUSION IN THE NORMS

Aptitudes were selected for tryout in the norms on the basis of a qualitative analysis of job duties involved and a statistical analysis of test and criterion data. Aptitudes G, V, S, Q and M which do not have significant correlations with the criterion were considered for inclusion in the norms because qualitative analysis indicated that they were important for job duties and the sample had a relatively high mean score on Aptitudes G, S and M and a relatively low standard deviation on Aptitudes G, V, S and Q. Aptitude F was considered in the trial norms since it was considered important for the performance of job duties and the sample had a relatively high correlation with the criterion on this aptitude. Tables 3, 4 and 5 show the results of the qualitative and statistical analysis.

TABLE 3

Qualitative Analysis
(Based on the job analysis, the aptitudes indicated appear to be important to the work performed)

Aptitude	Rationale
G - General Learning Ability	Complex training program and intensive study of complicated products.
V - Verbal Ability	Specialized technical terminology and manuals.
N - Numerical Aptitude	Some simple calculation; some mathematical logic in the training programs.
S - Spatial Aptitude	Ability to visualize component relationships.
P - Form Perception	Ability to recognize dislocation of parts.
Q - Clerical Perception	Ability to perceive details in specifications accurately, plus possible fine-form perception.
F - Finger Dexterity	Need for rapid, disassembly and adjustment skills with small parts.
M - Manual Dexterity	Need for using hand tools and making repairs.

TABLE 4

Means, Standard Deviations (σ), Ranges and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB (N=50)

Aptitudes	Mean	σ	Range	r
G - General Learning Ability	118.8	11.0	99-152	.267
V - Verbal Ability	109.2	9.6	88-131	.030
N - Numerical Aptitude	113.7	13.6	76-143	.347*
S - Spatial Aptitude	120.4	13.2	94-160	.165
P - Form Perception	113.4	13.4	85-138	.098
Q - Clerical Perception	112.4	11.8	90-153	.017
K - Motor Coordination	106.8	15.3	70-140	.087
F - Finger Dexterity	104.8	18.3	58-141	.277
M - Manual Dexterity	115.7	18.0	74-162	.075

TABLE 5

Summary of Qualitative and Quantitative Data

Type of Evidence	Aptitudes								
	G	V	N	S	P	Q	K	F	M
Job Analysis Data: Important	X	X	X	X	X	X		X	X
Irrelevant									
Relatively High Mean	X			X					X
Relatively Low Standard Deviation	X	X		X		X			
Significant Correlation with Criterion			X					X*	
Aptitudes to be Considered for Trial Norms	G	V	N	S		Q		F	M

*Although not significant at the .05, the correlation closely approaches it.

DERIVATION AND VALIDITY OF NORMS

Final norms were derived on the basis of the degree to which trial norms, consisting of various combinations of aptitudes G, V, N, S, Q, F and M at trial cutting scores, were able to differentiate between the 68% of the sample considered to be good workers and the 32% of the sample considered to be poor workers. Trial cutting scores at five-point intervals approximately one standard deviation below the mean are tried because this will eliminate about one-third of the sample with three-aptitude norms. For four-aptitude trial norms, cutting scores of slightly less than one standard deviation below the mean will eliminate about one-third of the sample; for two-aptitude trial norms, minimum cutting scores of slightly more than one standard deviation below the mean will eliminate about one-third of the sample. The Phi Coefficient was used as a basis for comparing trial norms. Norms of N-95, S-100, F-75 and M-100 provided optimum differentiation for the occupation of Technician, Automated Equipment (office mach.) 823.281-044. The validity of these norms is shown in Table 6 and is indicated by a Phi Coefficient of .47 (statistically significant at the .0005 level).

TABLE 6
Concurrent Validity of Test Norms
N-95, S-100, F-75 and M-100

	Nonqualifying Test Scores	Qualifying Test Scores	Total
Good Workers	3	31	34
Poor Workers	9	7	16
Total	12	38	50

Phi Coefficient ϕ = .47

Chi Square (X^2_y) = 10.9

Significance level = $P/2 < .0005$

DETERMINATION OF OCCUPATIONAL APTITUDE PATTERN

The data for this study did not meet all the requirements for incorporating the occupation studied into an OAP. However, the occupation was placed as an * * occupation in OAP-37 which is shown in the 1970 edition of Section II of the Manual for the GATB. A phi coefficient of .35 is obtained when the OAP-37 norms of N-80, S-95, M-85 are applied to the data.

PERFORMANCE EVALUATION CHART

Dec. ____ Branch ____ Date 2/11/57

INSTRUCTIONS

1. Read all five specifications for the factor QUANTITY.

2. The term "SPECIFIED" for the factor QUANTITY means that measure of quantity which is reasonable for an average employee as determined by the immediate supervisor.

3. Determine which specification most nearly fits the performance of the employee.

4. Place an X in the box of the specification which most nearly fits the performance of the employee.

5. Repeat for the factors QUALITY, KNOWLEDGE OF JOB, INITIATIVE, COOPERATION, WORK HABITS and CUSTOMER RELATIONS.

116

FACTOR					
QUANTITY Consider output of work during a given period of time.	☐ Output consistently low on most operations; A slow worker.	☒ Frequently turns out less than specified amount of work on many operations.	☐ Consistently turns out specified amount of work on most operations.	☐ Frequently turns out more than specified amount of work on many operations; A fast worker.	☐ Output outstanding high; Consistently turns out exceptionally large amount of work.
QUALITY Consider extent to which work meets quality standards; Amount of spoilage, rejections, and rework.	☐ Work seldom meets specified quality; Many rejections, spoilages, or rework.	☒ Work frequently below specified quality; Apt to make mistakes; Moderate amount of rejections, spoilages, or rework.	☐ Work meets standards; A careful worker; Minor amount of rejections, spoilages, or rework.	☐ Work consistently meets specified quality; An accurate worker; Negligible amount of rejections, spoilages, or rework.	☐ Work of exceptional high quality; An outstandingly precise & accurate worker; Rarely makes errors.
KNOWLEDGE OF JOB Consider Technical knowledge of all duties and assignments of job classification.	☐ Limited to the simplest duties or assignments within his classification. Lacks knowledge of other work within classification.	☐ Limited to selected duties or assignments within his classification. Has poor knowledge of other work within classification.	☒ Performs most of the duties or assignments within his classification; Has fair working knowledge of other work within classification.	☐ Performs any of the duties or assignments within his classification; Has good working knowledge of all work within classification.	☐ Excellent knowledge all duties or assignments within his classification. Has exceptionally good working knowledge of all work within classification.
INITIATIVE/SELF-RELIANCE Consider ability to take action without being told. Requires minimum of supervision.	☐ Little drive. Requires abnormal amount of supervision.	☒ Sometimes hesitant to act. Demands direction in performance of work.	☐ Generally progressive. Completes most assignments with minor amount of supervision.	☐ Makes constructive suggestions for more efficient method of performing job. Requires little direction.	☐ Extremely resourceful. Rarely requires direction in performance of work.
COOPERATION Consider ability to work with others; To accept suggestions and direction; To understand & respond to needs & requirements of others.	☐ Does not work well with others, frequently irritates and aggravates others. Unwilling to accept suggestions and direction.	☐ At times, does not cooperate with others. Reluctant to accept suggestions and direction.	☒ Generally cooperative. Usually willing to accept suggestions and direction.	☐ Cooperates well with others. Willingly accepts suggestions and direction.	☐ Exceptionally cooperative. Understanding and responsive to needs & requirements of others. Willingly accepts suggestions and direction.
WORK HABITS Consider such things as attendance, punctuality, neatness, & adherence to working Company regulations.	☐ Frequently fails to display good work habits.	☒ Occasionally fails to display good work habits.	☐ Displays good work habits.	☐ Displays excellent work habits.	☐ Displays outstanding work habits.
CUSTOMER RELATIONS Consider courtesy & interest shown customers; Voice &	☐ Numerous complaints of poor courtesy & lack of interest shown customers; Voice &	☒ Occasional complaints of lack of interest shown customers; Phone &	☐	☐	☐

12

9

APPRAISAL FORM

Form 421-2[illegible]

BRANCH

DATE

QUANTITY Consider output of work during a given period of time.					QUALITY Consider extent to which work meets quality standards; Amount of spoilage, rejections, and re-work.					KNOWLEDGE OF JOB Consider Technical knowledge of all duties and assignments of job classification.					INITIATIVE/SELF-RELIANCE Consider ability to take action without being told. Requires minimum of supervision.					COOPERATION Consider ability to work with others; To accept suggestions and direction; To understand & respond to needs & requirements of others.					WORK HABITS Consider such things as attendance, punctuality, time-off, & adherence to governing Company regulations					CUSTOMER RELATIONS Consider ability to instill customer confidence in self & product, & to enhance Company image.					TOTAL POINTS
8	16	24	32	40	8	16	24	32	40	10	20	30	40	50	4	8	12	16	20	6	12	18	24	30	4	8	12	16	20	10	20	30	40	50	
10	20	40	20	10	10	20	40	20	10	10	20	40	20	10	10	20	40	20	10	10	20	40	20	10	10	20	40	20	10	10	20	40	20	10	
				X					Y					Y					X					X				X					Y		236
			Y				Y					Y					Y					X					Y					Y			158
		X					Y					Y					X					X					X					X			150
			Y					X					X					X						X					A					X	230
		X					Y					X					Y					X					Y					X			150
		Y					Y					X					Y					X					Y					/			150
		Y	3	E	1		X	3				X	3				X	3				Y	3				V	3				Y	3	2	150
		Y						X					X					X						X						X				X		196
	X					Y					Y					X					X						X					Y			100
	X					X					X					X					X						Y					Y			100
X					Y					X					Y					X					X					X						50

August 1971

S-463

FACT SHEET

Job Title:

Technican, Automated Equipment (office mach.) 823.281-044

Job Summary:

Installs, repairs and services data-origination and communication equipment, such as Flexowriter, Teledata, Collectodata, auxiliary input and output components.

Work Performed:

Using hand or power tools, soldering equipment, and testing instruments such as multimeter, sets up, wires if necessary, tests for operation, and services the equipment on customer's premises. After equipment has been in operation, repairs and services on customer demand and/or at periodic intervals; disassembles machine and examines parts for wear or defects; adjusts, repairs or replaces parts; cleans and oils them if necessary, reassembles and tests for proper operation. May give instruction on operation and care to customer's personnel.

Effectiveness of Norms:

Of the non-test-selectd workers used for this study 68% were good workers; if the workers had been test-selected with the S-463 norms, 82% would have been good workers. Of the non-test-selected workers, 32% were poor workers; if they had been test-selected with the S-463 norms, 21% would have been poor workers.

Applicability of S-463 Norms:

The aptitude test battery is applicable to jobs which include a majority of the duties described above.

GPO 918-033